Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE (9–1)

Centre Number | | | | | |

Candidate Number | | | | |

Friday 7 June 2019

Afternoon (Time: 1 hour 15 minutes) | Paper Reference **4BI1/2BR**

Biology

Unit: 4BI1

Paper: 2BR

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.
- Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Information

- The total mark for this paper is 70.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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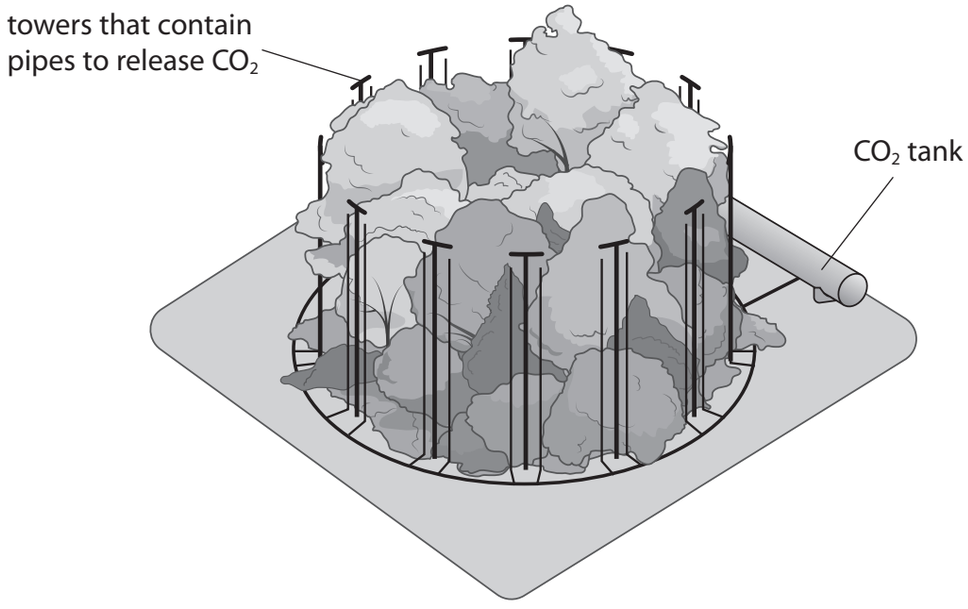
Pearson

Answer ALL questions.

1 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

The FACE Programme



The global concentration of carbon dioxide (CO_2) in the atmosphere has risen by 35% since 1800. It is higher now than at any time in the past 25 million years and is predicted to increase further by 2050.

Free air carbon dioxide enrichment (FACE) is when scientists increase the concentration of CO_2 in the air surrounding crop plants. A typical FACE plot is circular and surrounded by a ring of pipes. These pipes release CO_2 at the base of the plant and all the way to the top of the plant. Wind direction, wind speed and CO_2 concentration are measured at the centre of each plot. A computer uses this information to maintain a high concentration of CO_2.

Plants do not just respond to increasing CO_2 in the atmosphere. They can also change the concentration of CO_2 by increasing the amount they absorb. Much of what we used to know about plant responses to rising CO_2 came from studies in glasshouses. However, in FACE experiments the effect of increasing CO_2 can be studied in a natural environment. This should provide a better idea of how plants and ecosystems will respond to higher global concentrations of CO_2.

One of the effects of higher concentrations of CO_2 is an increase in the rate of photosynthesis. FACE experiments were done in various parts of the world using different plant species. In these experiments, raised CO_2 concentrations increased the rate of photosynthesis by about 40%. CO_2 concentrations also affect how open stomata are. Open stomata allow CO_2 to diffuse into leaves for photosynthesis, but also allow water to escape from leaves. Plants respond by changing how open their stomata are as a compromise. As CO_2 concentrations increase, plants can maintain a high rate of photosynthesis with a lower rate of transpiration. Growth with raised CO_2 decreases water loss by about 22%. This can have consequences for the water cycle of entire ecosystems.

In FACE experiments, dry mass production increased by about 30%. This increased growth leads to a greater yield in crops such as wheat, rice and soybean.

(a) Explain why the carbon dioxide concentration is predicted to increase further by 2050 (line 3).

(2)

(b) Suggest why wind direction and speed are measured in FACE plots (lines 7 and 8).

(1)

(c) Scientists conclude that FACE experiments are more useful than experiments in glasshouses (lines 11 to 15).

Evaluate this conclusion.

(3)

(d) Explain why an increase in carbon dioxide concentration would lead to an increase in the rate of photosynthesis (lines 16 to 17).

(2)

(e) Describe an experiment to estimate the rate of water loss from a plant.

(4)

(f) Plants respond by changing how open their stomata are as a compromise (lines 21 to 22).

Explain the compromise that plants must make.

(2)

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(g) An increased concentration of carbon dioxide in the atmosphere is causing climate change.

Scientists hope that an increase in the rate of photosynthesis may limit climate change.

Describe three other methods of reducing climate change.

(3)

1 .....

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2 .....

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3 .....

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(Total for Question 1 = 17 marks)

2 Ecology is the study of organisms in their environment.

(a) (i) State what is meant by the term **population**.

(1)

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(ii) State what is meant by the term **community**.

(1)

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.....

(iii) State what is meant by the term **ecosystem**.

(1)

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.....

(b) Which of these is an abiotic factor?

(1)

☒ **A** availability of mates

☒ **B** number of pathogens

☒ **C** number of predators

☒ **D** acidity of soil

(c) Which apparatus would be suitable for estimating the population size of a woodland plant?

(1)

☒ **A** potometer

☒ **B** quadrat

☒ **C** spotting tile

☒ **D** sweep net

(d) Describe how the biodiversity of a woodland differs from the biodiversity of a farmed field of wheat plants.

(2)

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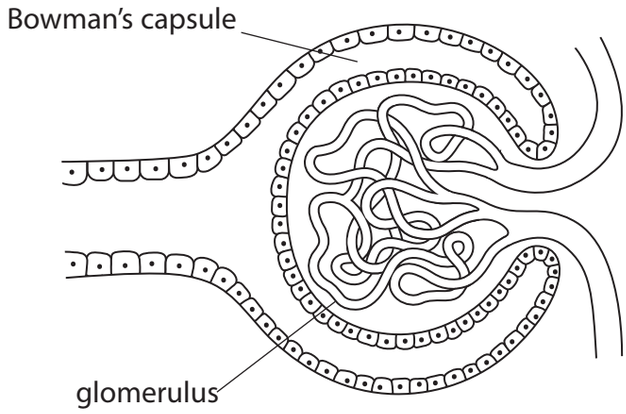
(Total for Question 2 = 7 marks)

3 The diagram shows part of a kidney nephron.



(a) Where is this part of a kidney nephron located?

(1)

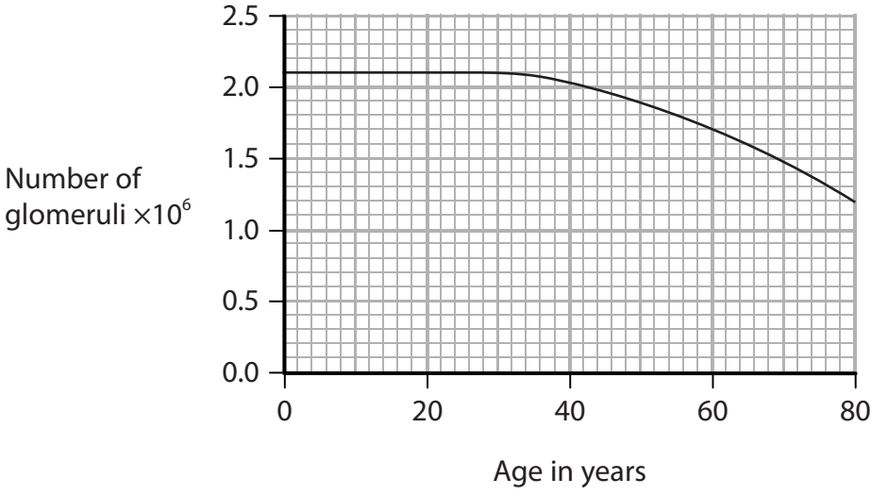
☒ **A** in the cortex

☒ **B** in the collecting duct

☒ **C** in the loop of Henle

☒ **D** in the medulla

(b) The graph shows the effect of age on the number of glomeruli in the kidneys.



Using the graph, determine the age of a person with 1 600 000 glomeruli in their kidneys.

(1)

age = ... years

(c) The table lists three molecules. It also gives their concentrations in the glomerulus, the Bowman's capsule and the bladder.

Molecule	Concentration in glomerulus (%)	Concentration in Bowman's capsule (%)	Concentration in bladder (%)
protein	8.00	0.00	0.00
glucose	0.10	0.10	0.00
urea	0.03	0.03	2.00

Explain the difference between the concentration of each substance in the glomerulus and in the bladder.

(4)

(Total for Question 3 = 6 marks)

4 Chocolate contains small amounts of a substance called theobromine.

In high amounts, theobromine is poisonous to animals.

The table shows the mass of theobromine per kg of body mass that is poisonous for five different species.

Species	Mass of theobromine per kg of body mass in mg
cat	200
dog	300
mouse	837
human	1000
rat	1265

(a) (i) The mass of theobromine per kg that is poisonous differs between species. Compare the poisonous effect in cats and rats.

(2)

(ii) A small bar of chocolate contains 200 mg of theobromine.

Explain why eating chocolate bars is unlikely to poison a man of mass 70 kg.

Include a calculation in your answer.

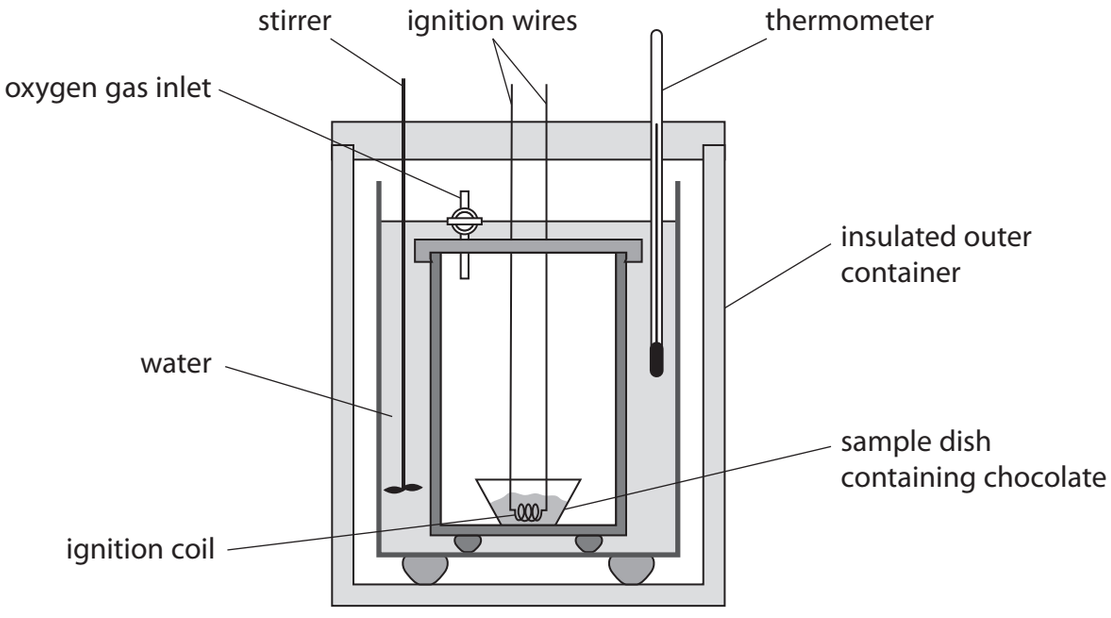
(2)

(b) Theobromine prevents the release of ADH.

Explain why preventing the release of ADH can be harmful to humans.

(4)

(c) The diagram shows a calorimeter, which is used to measure the energy content of a food sample.



Explain the measurements and the calculations you would use to compare the energy content of milk chocolate and dark chocolate.

(4)

(Total for Question 4 = 12 marks)

5 The photograph shows a breed of dog called an English Springer Spaniel.

(Source: © 2016–2018. Sherpa Multimedia, Inc)

Phosphofructokinase deficiency (PFK) is an inherited disease in this breed of dog.

The disease causes red blood cells to burst.

(a) Explain why dogs with PFK find it difficult to exercise.

(2)

(b) PFK is caused by a recessive allele.

The table lists the genotypes of some parents.

Complete the table by giving the percentage of offspring likely to have PFK for each set of parents.

The first one has been done for you.

(2)

Genotype of parents	Percentage of offspring likely to have PFK
both homozygous dominant	0
heterozygous x heterozygous	
heterozygous x homozygous recessive	

(c) A dog breeder is someone who breeds dogs and sells the offspring.

Explain the advantage for the dog breeder of using homozygous dominant dogs as parents.

(2)

(d) A dog breeder buys a healthy dog.

The dog shows no signs of PFK, but the breeder does not know its genotype.

Explain why the breeder mates this dog with a dog that has PFK.

(2)

(e) Part of the base sequence in the strand of DNA used to make the protein phosphofructokinase is CAGGTATGG.

(i) Which of these shows the base sequence of mRNA produced from this strand of DNA?

(1)

☒ **A** CAGGTATGG

☒ **B** CAGGUAUGG

☒ **C** GTCCATACC

☒ **D** GUCCAUACC

(ii) The mutated base sequence for the same strand of DNA is CAGTTATGG.

Explain why the mutated base sequence makes a different protein than the normal DNA.

(3)

(Total for Question 5 = 12 marks)

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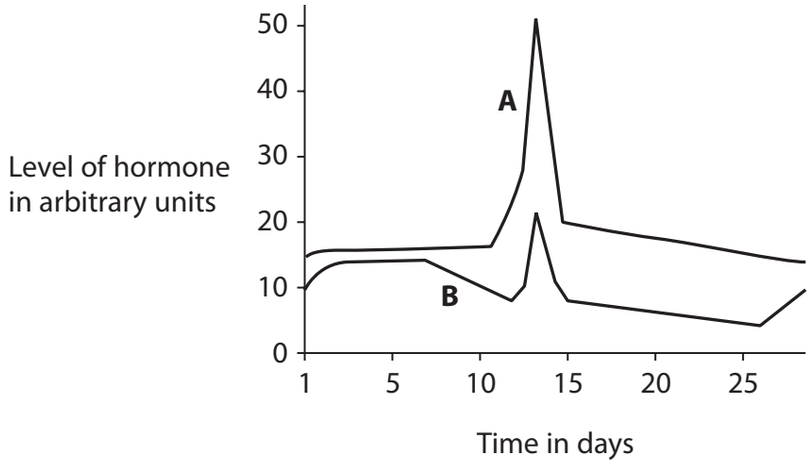
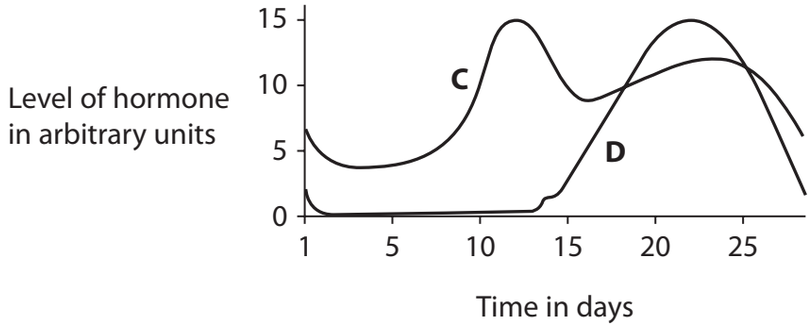
6 The graphs show changes in the levels of four hormones, A, B, C and D, that control the menstrual cycle.





(a) Hormone A stimulates ovulation.

(i) Give the name of this hormone.

(1)

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(ii) State what is meant by the term **ovulation**?

(1)

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(b) Give the name of hormone D.

(1)

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(c) State the source of hormones C and D.

(1)

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(Total for Question 6 = 4 marks)

7 The table shows information about world fish supply from 2009 to 2014.

Source	Fish supply in million tonnes					
	2009	**2010**	**2011**	**2012**	**2013**	**2014**
wild	90	89	94	91	93	93
farmed	56	59	62	66	70	74
total	146	148	156	157	163	167

(a) (i) Calculate the difference between the percentage of total fish production that is farmed in 2009 and the percentage of total fish production that is farmed in 2014.

(3)

difference = ...

(ii) Describe the changes in fish supply from 2009 to 2014.

(3)

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(b) Farming large numbers of fish can cause problems for fish farmers.

Discuss how fish farmers solve these problems.

(6)

(Total for Question 7 = 12 marks)

TOTAL FOR PAPER = 70 MARKS

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